

Claims

1. Cellulose derivative having gel-like rheological properties in aqueous solution characterized in that
 - a) cellulose is alkalized with aqueous alkali metal hydroxide in the presence of a suspension medium,
 - b) the alkalized cellulose is reacted with one or more alkylene oxides,
 - c) then reacted with an alkyl halide present in the suspension medium
 - d) subsequently or simultaneously the alkalized cellulose is reacted with a crosslinking agent in an amount of 0.0001 to 0.05 eq, where the unit "eq" represents the molar ratio of crosslinking agent relative to the cellulose anhydroglucose unit (AGU), and
 - e) after if appropriate further addition of alkali metal hydroxide and/or alkylating agent, the resultant irreversibly crosslinked cellulose derivative is separated off from the resultant reaction mixture, optionally purified and dried.
2. Cellulose derivative according to Claim 1, characterized in that the crosslinking agent is one or more bifunctional reagents.
3. Cellulose derivative according to Claim 1, characterized in that the crosslinking agent is epichlorohydrin.

4. Cellulose derivative according to Claim 1, characterized in that the rheological profile in aqueous solution of the cellulose derivative is characterized in that the linear viscoelastic material functions storage modulus G' and loss modulus G'' of a solution of 1.5 to 2.0 parts by weight of the cellulose derivative per 100 parts by weight of solution at a temperature of $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$, and when water without further additives is used as solvent, in the range of angular frequency ω of 0.1 s^{-1} to 1 s^{-1} are a function of the angular frequency wherein the exponents n and m of the relationships:

$G' \propto \omega^n$ (storage modulus is proportional to the angular frequencies of the power n)

and

$G'' \propto \omega^m$ (loss modulus is proportional to the angular frequency to the power m)

are approximately identical, where for the cellulose derivative of this invention the ratio of n to m is from 0.80 to 1.20.

5. Cellulose derivative according to Claim 4, characterized in that the linear viscoelastic material functions storage modulus G' and loss modulus G'' of a solution of 1.5 to 2.0 parts by weight of the cellulose ether per 100 parts by weight of solution at a temperature of $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$, and when a solvent of 98 parts by weight of water and 2 parts by weight of sodium hydroxide per 100 parts by weight of solvent is used, in the range of angular frequency ω from 0.1 s^{-1} to 1 s^{-1} , are a function of the angular frequency wherein the exponents n and m of the relationships:

$G' \propto \omega^n$ (storage modulus is proportional to the angular frequencies of the power n)

and

$G'' \propto \omega^m$ (loss modulus is proportional to the angular frequency to the power m)

5 are approximately identical, where for the cellulose ethers of this invention the ratio of n to m is from 0.80 to 1.20.

6. Cellulose derivative according to either of Claims 4, characterized in that the selection of the solvent

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A: water

or

B: 98 parts by weight of water and 2 parts by weight of sodium hydroxide per 100 parts by weight of solvent

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has only a slight effect on the ratio of the two exponents n and m, where the difference between the ratio of n to m in solvent A and the ratio of n to m in solvent B under otherwise identical conditions is less than 20 of 100 of the mean of the ratio of n to m in solvent A and the ratio of n to m in solvent B.

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7. Cellulose derivative according to Claim 1, characterized in that the cellulose derivative is a hydroxyethyl cellulose derivative, a methyl cellulose derivative, a methylhydroxypropyl cellulose derivative, or a methylhydroxyethyl cellulose derivative.

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8. Process for preparing a cellulose derivative according to Claim 1, comprising

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a) alkanizing cellulose with aqueous alkali metal hydroxide in the presence of a suspension medium,

- b) reacting the alkalized cellulose with one or more alkylene oxides,
- 5 c) then reacting with an alkyl halide present in the suspension medium
- d) subsequently or simultaneously reacting the alkalized cellulose with a crosslinking agent in an amount of 0.0001 to 0.05 eq, where the unit "eq" represents the molar ratio of crosslinking agent relative to the anhydroglucose unit (AGU) of the cellulose used, and
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- e) after if appropriate, further addition of alkali metal hydroxide and/or alkylating agent, separating off the resultant irreversibly crosslinked cellulose derivative from the reaction mixture, optionally purifying and drying the irreversibly crosslinked cellulose derivative.
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- 20 9. Process according to Claim 8, characterized in that, in step a), the cellulose is alkalized using aqueous alkali metal hydroxide in the presence of a suspension medium which comprises alkyl halide in the amount calculated from the following formula: [equivalents of alkali metal hydroxide per AGU minus 1.4] to [equivalents of alkali metal hydroxide per AGU plus 0.8], and in step e) alkyl halide is added in an amount which is at least the difference between the number of equivalents of alkyl halide per AGU already added and the total amount of alkali metal hydroxide per AGU added, where this amount is a minimum of 0.2 equivalents per AGU, and, optionally, further alkali
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- 30 metal hydroxide.

10. Process according to Claim 8, characterized in that the alkyl halide is methyl chloride.
- 5 11. Process according to Claim 8, characterized in that the crosslinking agent is dissolved in methyl chloride or a methyl chloride/dimethyl ether mixture.